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been excluded, and *vice versa*. The natural rhythm of response may be increased or diminished, provided the latent period of the organ is less than the daily period of light and darkness.

This work is one that will be needed in every active laboratory, so that any more detailed statements of its conclusions would be superfluous.—C. R. B.

NOTES FOR STUDENTS

Plant breeding.—Bulletins of the various Agricultural Experiment Stations usually deal with the practical side of agricultural problems, and there has not been at all times a recognition of the practical value of theoretical matters emanating from pure scientific sources.

One can only commend the purpose of Dr. E. M. EAST[3] in issuing a bulletin in which a well-written review of the development of the evolution idea is given, along with the more recent developments in our knowledge of variations and of heredity. In the main the treatment is well balanced, but in some respects there is too obvious a leaning on MORGAN'S recent publications. Particularly does it seem out of place, in so brief a paper, to present MORGAN'S theory of the impurity of the gametes—a theory which has lost practically all the slight support it seemed to have when first propounded.

It is noted on p. 68 in the discussion of the Belgian-hare cross, as an illustration of "masked" characters, that the older explanation is retained, based upon the supposed presence of a black factor in the albino. CASTLE[4] has given a more satisfactory explanation of such cases by assuming an "agouti factor" which distributes the pigment in distinct regions in each hair, giving a grey effect. The Belgian hare of the experiment cited had both dominant characters, namely pigment and agouti, and the albino lacks them both. The advantage of CASTLE'S explanation lies in the fact that it brings such cases into harmony with the "presence and absence" hypothesis which has found such wide support in other cases and to which the author of the bulletin himself subscribes.

The section on "Methods of plant improvement" is doubtless the most valuable part of the paper. Its scope may be indicated by the subheads: "The selection of fluctuations," "Isolation of elementary species," "Judging plants by their progeny," "Correlated characters," "Improvement by hybridization." Under the first of these subheads a valuable summary is given of the results gained by HOPKINS and his associates at the Illinois Experiment Station in the breeding of maize for high and low protein and high and low oil content. The crop averages for ten years are given, showing that in this time the maximum separation of the extremes with respect to these characters seems to have been attained.

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[3] EAST, E. M., The relation of certain biological principles to plant breeding. Conn. Agric. Exp. Sta., Bull. 158. pp. 93. *figs. 6.* 1907.

[4] CASTLE, W. E., On a case of reversion induced by cross breeding and its fixation. Science N. S. **25**:151–153. 1907.

On p. 62 the "Knight-Darwin law" that "nature abhors perpetual self-fertilization" is amended to read, "nature resists any sudden change in long-established conditions." A suggestion having the same import was made some years ago by HAYS,[5] but this seems to have been overlooked by Dr. EAST. HAYS says, "possibly DARWIN'S law would more broadly cover the truth if expressed thus: nature abhors a radical change which would require species to cross in much closer or in much more radical relationship than is their long-established habit."

The last ten pages preceding the summary discuss the technique of maize breeding, giving an insight into the great complexity of the problems to be solved in breeding this crop, owing to the occurrence of fluctuations and numerous elementary species, and the injurious effects of too close inbreeding. The author's experience in maize breeding, as an associate of HOPKINS at the Illinois Station, and his continued efforts along similar lines at the Connecticut Station, have thoroughly qualified him to write on this subject, and his discussion will doubtless prove of great value to maize breeders; but the reviewer questions the correctness of the assumption that the isolation of pure strains of maize is the proper aim of those who would secure the greatest possible improvement in this crop.

It is believed that this excellent bulletin will have such a reception that other stations will follow Dr. EAST'S example in disseminating advanced scientific information.—G. H. SHULL.

The latent life of seeds.—Two rival doctrines have been used heretofore, with equal success, to account for the latent life of seeds. The one holds that life is completely suspended, all the exchanges, both of matter and of energy, being arrested. The other holds that the phenomena of metabolism are greatly diminished, but that they are never entirely suppressed. Both of these theories have been supported by experimental evidence, and the question has called forth a very large number of investigations. These antagonistic views have led BECQUEREL to a further study,[6] with the idea that the previous conflicting results depended upon neglected properties of the integuments. He has demonstrated the impermeability for gases of the integuments of seeds of a considerable number of species; and it seems GOLA[7] simultaneously had discovered impermeability for water to be a common character.

These facts make it necessary to go over previous experiments, perforating the integuments or removing them. Seeds which resist the action of alcohol, ether, and chloroform, when their integuments are intact, succumb when these agents are brought into actual contact with the embryo. But low temperatures, even to −210°, do not have any appreciable effect on germination if the protoplasm has already undergone thorough desiccation. The existence of gaseous exchanges,

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[5] HAYS, W. M., Plant breeding. U. S. Division of Physiology and Pathology, Bull. No. 29. pp. 72. *figs. 21.* 1901. (See pp. 38, 39.)

[6] BECQUEREL, PAUL, Recherches sur la vie latente de graines. Ann. Sci. Nat. Bot. IX. 5:193–320. 1907.

[7] As cited by BECQUEREL: GOLA, J., Mémoire sur la physiologie [in another place, Recherches sur] des téguments des graines. Acad. [Sci.] Turin. 1905.